A comparative study of type of Infective organisms and their antimicrobial sensitivity in Mesh infection in Ventral hernia repair between diabetic and non diabetic patients

Dissertation
Submitted in partial fulfillment of the regulations of

M.S. DEGREE EXAMINATION

BRANCH I GENERAL SURGERY

Department of General Surgery

GOVT. STANLEY MEDICAL COLLEGE AND HOSPITAL

CHENNAI - 600001

THE TAMILNADU DR.M.G.R MEDICAL UNIVERSITY

CHENNAI

APRIL 2014

CERTIFICATE

This is to certify that this dissertation titled

"A comparative study of type of Infective organisms and their antimicrobial sensitivity in Mesh infection in Ventral hernia repair between diabetic and non diabetic patients "

is the bonafide work done by **Dr. Viswakumar.P,** Post Graduate student (2011 – 2014) in the Department of General Surgery, Government Stanley Medical College and Hospital, Chennai under my direct guidance and supervision, in partial fulfillment of the regulations of The Tamil Nadu Dr. M.G.R Medical University, Chennai for the award of M.S., Degree (General Surgery) Branch - I, Examination to be held in April 2014.

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DECLARATION

I, **DR. P.VISWAKUMAR** solemnly declare that this dissertation titled ***"A comparative study of type of Infective organisms and their antimicrobial sensitivity in Mesh infection in Ventral hernia repair between diabetic and non diabetic patients "*** is a bonafide work done by me in the Department of General Surgery, Government Stanley Medical College and Hospital, Chennai under the guidance and supervision of my unit chief.

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This dissertation is submitted to The Tamilnadu Dr. M.G.R. Medical University, Chennai in partial fulfillment of the university regulations for the award of M.S., Degree (General Surgery) Branch - I, Examination to be held in April 2014.

Place: Chennai.
Date: December 2013. **DR. P.VISWAKUMAR**

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INSTITUTIONAL ETHICAL COMMITTEE, STANLEY MEDICAL COLLEGE, CHENNAI-1

Title of the Work : A comparative study of type of infective organisms and their antimicrobial sensitivity in mesh infection in ventral hernia repair between diabetic and non diabetic patients

Principal Investigator : Dr.P.Viswakumar

Designation : PG in M S (General Surgery)

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The request for an approval from the Institutional Ethical Committee (IEC) was considered on the IEC meeting held on 08.04.2013 at the Council Hall, Stanley Medical College, Chennai-1 at 2PM

The members of the Committee, the secretary and the Chairman are pleased to approve the proposed work mentioned above, submitted by the principal investigator.

The Principal investigator and their team are directed to adhere to the guidelines given below:

1. You should inform the IEC in case of changes in study procedure, site investigator investigation or guide or any other changes.
2. You should not deviate from the area of the work for which you applied for ethical clearance.
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4. You should abide to the rules and regulation of the institution(s).
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6. You should submit the summary of the work to the ethical committee on completion of the work.

26/10/13

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CONTENTS

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Keywords: Ventral hernia,Mesh infection,Diabetic,Prosthetic mesh,Klebsiella,Stapylococcus aureus.

Abstract

Background:

Ventral hernia are the most frequently encountered hernia in a surgeons day today practice. Most common among them was incisional hernia which contributes about 15 to 20%.Most of the repairs now a days done using prosthetic mesh and hence its complication rate also increases. Prosthetic mesh infection is a catastrophic complication of ventral hernia repair.

Methods :

About 53 patients with mesh infection was included in study. The risk factors such as diabetes,obesity,COPD,smoking history were studied.To determine the microbial organisms between diabetic and non diabetic patients with mesh infection, culture were taken from DT fluid, exudate directly over the mesh incase

exposed mesh and their antibiotic sensitivity was studied.The results were tabulated and compared with both the group of patients.

Results :

From our study group we found among the risk factors diabetic was most important risk factor contributing about 57%.Most of this group of patients developed wound infection which in turn leads to development of mesh infection.Among diabetic patient Klebseilla pneumonia(51%) was most common organism followed by pseudomonas aeruginosa and both are sensitive to Amikacin (73%) followed by ciprofloxacin.In non diabetic group stap.aureus was commonest organism (43%) followed by Stap.epidermidis and Stap.aureus sensitive to Ampicillin and cefotaxime while Stap.epidermidis to Linzolid and Vancomycin in our institution.

Conclusion:

Mesh infection is a catastrophic complication of ventral hernia mesh repair causing considerable morbidity to patient and increase in health care cost for hospital too. So Higher-quality reporting on mesh infection in VIH repair must be achieved through better classification and quantification of these infections. Tactics to avoid mesh infection should be based on best evidence from prospective studies of each institution and following appropriate antibiotic prophylaxis based on their results as in our institution.

Introduction:

- Ventral hernia are the most frequently encountered hernia in a surgeons day today practice. Ventral hernia encompass a wide spectrum of hernias ranging from epigastric,Umblical to Incisional hernia.
- Most common of them are incisional hernia which commonly develops as a long term complication of any open abdominal surgery.
- When there was associated co morbid conditions which leads to poor wound healing and superadded wound infections in open abdominal surgery can contribute to the development of Incisional hernias.
- In other spectrum hernias such as Epigastric, Paraumblical, Umbilical and spigelian hernias occur without any preceding surgery due to inherent weakness in the anterior abdominal wall in addition to other chronic factors causing persistent intraabdominal pressure such as chronic cough, heavy weight lifter,etc.

- Many techniques were followed in repair of defect in the ventral abdominal wall includes anatomical closure of the defect with non-absorbable suture material, closure using component separation technique,etc were tried in olden days.
- Since failure rates were high in such anatomical repair alone new concept of reinforcement with synthetic mesh was arised and widely practiced all over the world.

- This leads to decrease in the incidence of recurrence of hernias after surgical repair but not entirely complication free.
- With wide practice of mesh repair in ventral hernias the complication such as seroma development,mesh infection,mesh rejection are also on raise.
- Among the complication the mesh infection was one of the commonest and also grave complication leading to ultimate failure of surgery if not properly recognized and treated.
- Mesh infection was rare and separate entity from wound infection and both should not be clumped together.
- There are various factors contribute to development of mesh infection such as not adherence to surgical infection prevention guidelines,Poor surgical technique,Patient co morbid conditions like diabetes,obesity,renal failure,prostatism,etc.
- As technical causes always preventable patient factors as mentioned above is difficult to manage and poses challenge to operating surgeon.
- Among the patient related factors diabetes is one of the commonest one causing mesh infection,poor wound healing and failure of surgery.
- So here in our study we compared the commonest infective organism causing mesh infection between diabetic and non diabetic patients in our institution and to device appropriate antibiotic prophylaxis in these groups as it is difficult to treat once the infection sets in.

AIMS & OBJECTIVES:

1) To find out the type of infective organisms causing mesh infection between diabetic and non diabetic patients.

2) To know the antibiotic sensitivity of those organisms.

3) To choose appropriate antibiotic prophylaxis and treatment.

4) To compare the commonest organism prevalent between diabetic and non diabetic patients.

5) To find out effect of other comorbid conditions associated with mesh infection.

Review of Literature:

Historical background :

- Ehers papyrus (1552 BC) : First reference to hernia.
- Era sistratus of Keos(330-250 BC) : ‘Father of Physiology’ first performed hernia surgery.
- Heliodorus : Performed first laparotomy.
- Galen : First to introduce concept of hernia which was due to rupture of peritoneum and abdominal wall.
- Cooper (1804) : Delineated upper layer of superfiscial fascia in anterior abdominal wall.
- Scarpa (1820) : Delineated deep layer of superfiscial fascia.
- Phelps (1894) : First man made prosthetic material for hernia repair.
- Cheatle (1920-21) : Introduced surgery using midline incision of abdomen without entering peritoneal cavity.
- Francis usher (1958) : Created revolution in prosthetic materials used in hernia repair.He used polypropylene mesh.
- Ger (1982) : Introduced ‘intra-abdominal approach’ to correct abdominal wall hernias.

Development of Anterior Abdominal Wall:

- Abdominal wall develops from embryonic differentiation in early stages from lateral plate of embryonic mesoderm.
- At this stage embryo contain three layers
    1) Outer ectoderm
    2) Middle mesoderm
    3) Inner endoderm
- Mesoderm divided by clefts on each side of lateral plate which leads to development of somatic and splanchnic layer.
- Splanchnic layer along with endoderm form viscera by differentiating into blood vessels,muscle,connective and lymphatic.
- Somatic layer give rise to the development of abdominal wall.
- By 12^{th} week of gestation,the body wall is closed except umblical ring.
- Since alimentary tract develop more rapidly than coelomic cavity more of developing intestine comes out through umblical ring.
- After birth as umblical vessel no longer carry blood and omphalomesentric duct reduced to fibrous cord and stops communication with intestine.
- After umblical cord division the umblical ring closed by scaring rapidly.

Anatomy of Anterior Abdominal wall:

Anterior abdominal wall consists of nine layers starting from out to in are (Fig I)

1) Skin.
2) Subcutaneous tissue.
3) Superfiscial fascia.
4) External oblique muscle.
5) Internal oblique muscle.
6) Transverse abdomenus muscle.
7) Transversalis fascia.
8) Preperitoneal adipose tissue.
9) Peritoneum.

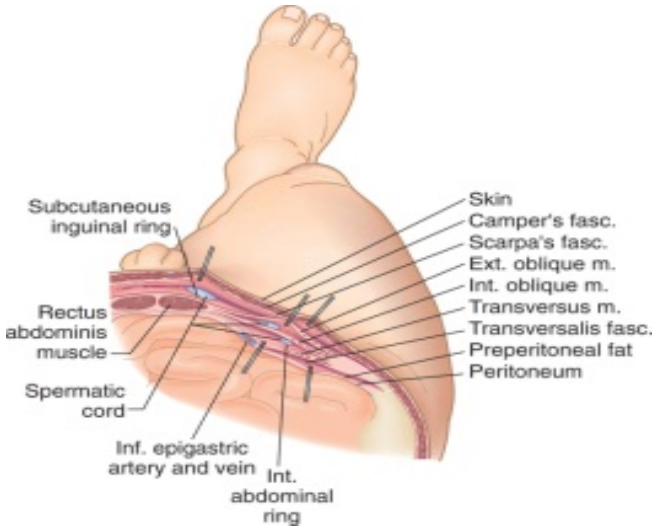


Fig I. The nine layers of anterior abdominal wall.

Subcutaneous Tissue:

- It contains two layers Superficial Camper's and deep Scarpa's fascia.
- Camper's Fascia is superfiscial and contains bulk of subcutaneous fat.
- Deeper to it is denser Scarpa's layer of fibrous connective tissue which is continuous with thigh's Fascia Lata.

Muscle and Investing Fascias:

- Muscles of anterior abdominal wall which includes External and Internal oblique,Transverse abdominus.
- These muscles cover the entire circumference of torso and anteriorly it give rise to broad flat aponeurotic layer covering the rectus abdominus muscle ,known as 'rectus sheath'.

External oblique:

- They arises from lower seven ribs and passes in superolateral and inferomedial direction. (Fig II.a)
- The posterior most fibres run straight downwards and inserts into anterior half of the iliac crest.(Fig II.B)
- At midclavicular line these muscle fibres form strong flat aponeurotic layer which passes anterior to rectus sheath and inserts into linea alba.

- The lower part of the muscle fibres rolls itself in posterior and superior direction extending from Anterior superior iliac spine to pubic tubercle forming ‘Poupart’s or Inguinal ligament’.
- Its forms lower free edge of external oblique muscle over which spermatic cord rests.
- Below the Inguinal ligament passes femoral vessels and nerve,Iliacus, pectineus and psoas major muscles.
- This shelving edge of Inguinal ligament used in various techniques for repair of Inguinal hernias.

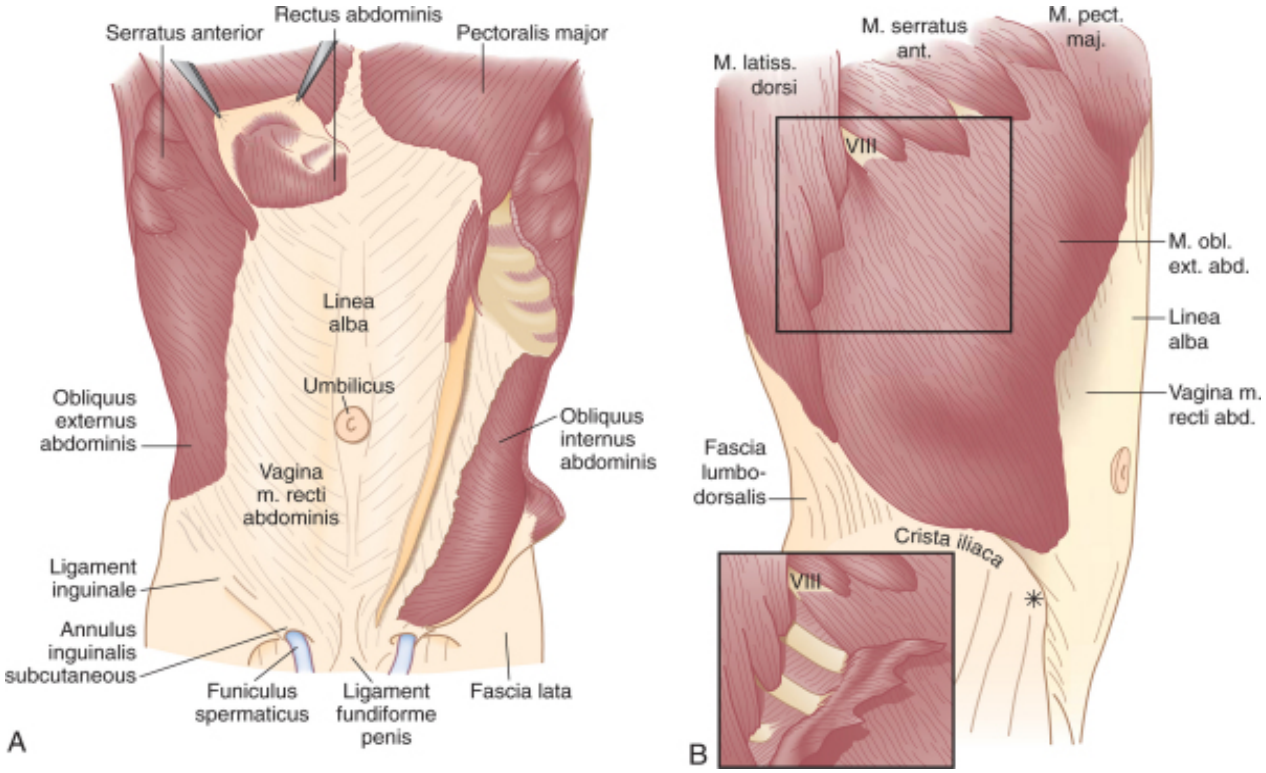


Fig II.a) External oblique,internal oblique and rectus muscle. B) Lateral view of External oblique muscle and its various insertions.

Internal oblique:

- This muscle arises from Iliopsoas fascia below the lateral half of inguinal ligament,Anterior 2/3rd of Iliac crest and Lumbodorsal fascia.
- These muscle fibres run in the direction opposite to external oblique i.e, Inferolateral to Superomedial. They inserts into Lower five ribs and their cartilages.(Fig III)
- At Semilunar line the central fibres form aponeurosis and above Semicircular line of Douglas this layer splits into two forming rectus sheath both anteriorly and posteriorly and inserts medially into Linea alba. Below the semicircular line it forms only anterior layer of rectus sheath.
- Lower most fibres parallels the spermatic cord and inserted into pubic symphysis and tubercle. Its lower fascicles accompany spermatic cord as cremaster muscle

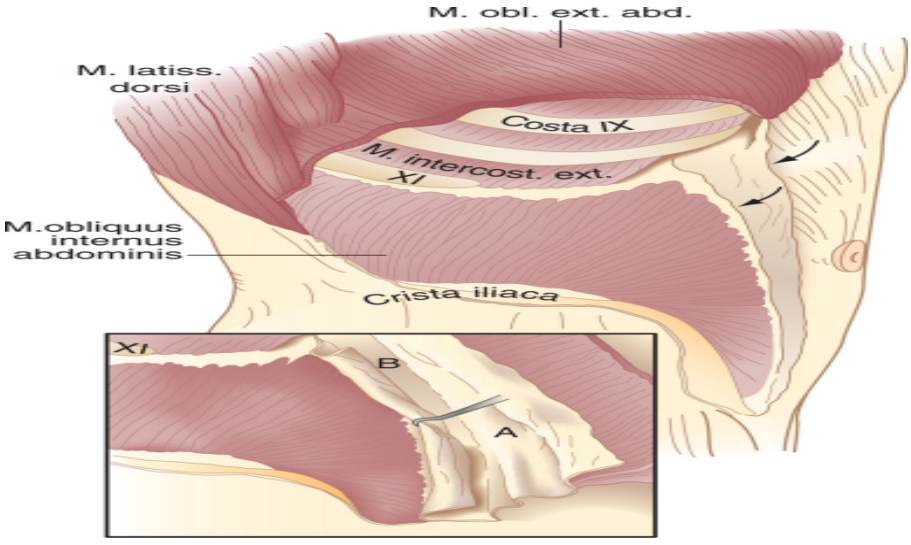


Fig III) Lateral view of Internal oblique after Ext.oblique removed.

Transverse abdominus muscle:

- They are the smallest of three muscle in the anterolateral abdominal wall.
- It originates from lower six costal cartilages,Lumbar spine,iliac crest and iliopoas fascia beneath the lateral 3rd of inguinal ligament .Fig(IV)
- They forms the aponeurotic sheath at semilunar line and passes posterior to rectus above semicircular arch and anterior to rectus below it before inserting into linea alba.
- The lower most fibres along with lowest fibres of internal oblique forms the aponeurotic arch of transverse abdominus muscle.
- This arch forms the superior boundary of Hesselbach's Triangle.

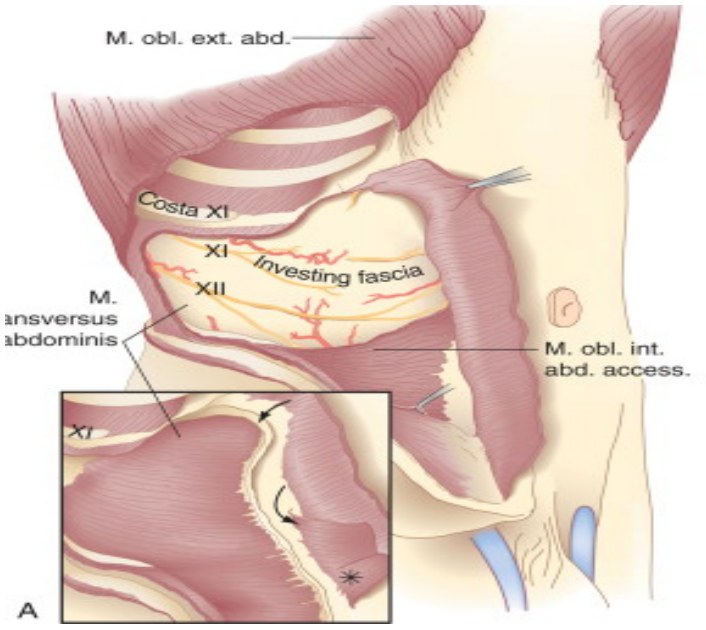


Fig (IV). Anterolateral view of Transverse abdominus muscle.

Fascia transversalis:

- They forms a complete fascial envelop around the coelomic cavity.
- This fascia lines the deep surface of transverse abdominus muscles and its extensions.(Fig V)
- They also called by different names depending on their location namely iliopsoas fascia,obturator fascia and inferior fascia of diaphragm.
- This fascia binds the muscle and aponeurotic fascicles together and hence strengthens the weak areas where the aponeurotic layer is thin.
- Fascia transversalis responsible for structural integrity of abdominal wall.
- Hence hernia is defined as the defect in fascia transversalis.

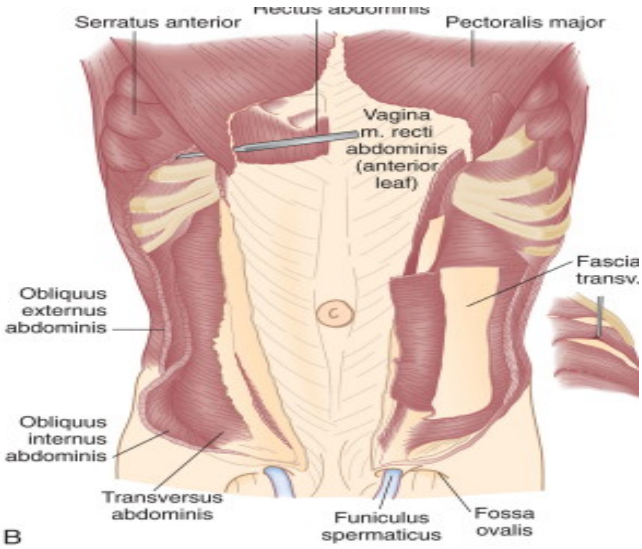


Fig (V): Anterior view of transverse abdominus muscle(Left) showing fascia transversalis (Right).

Rectus Abdominus:

- These are paired muscle which origates from anterior surfaces of fifth,sixth and seventh costal cartilages, Xiphoid process and inserts at pubic crest and pubic symphysis.
- They appear as flat,long triangular ribbon at their origin.
- There are 3 to 5 tendinous inscriptions which attach them to rectus sheath.
- Two muscles lie adjacent to each other and separated by linea alba.
- In addition to supporting abdominal wall they are powerful flexors of vertebral column.
- Rectus muscles are enclosed within the rectus sheath formed by lateral abdominal muscles.
- Above semicircular line this sheath completely encloses anterior and posterior aspect of the muscle while below it posterior surface is only covered with fascia transversalis.
- Anterior rectus sheath is formed by aponeurosis of external oblique and anterior lamina of internal oblique and below semicircular line transverse abdominus also forms part of anterior sheath.
- Posterior rectus sheath formed by posterior lamina of internal oblique aponeurosis and transverse abdominus aponeurosis.

- Linea alba formed by criss crossing fibres of broad lateral abdominal muscle extending from xiphoid process above to pubic symphysis below.
- They helps to held rectus muscle in anterior midline in close apposition.

Preperitoneal space and peritoneum :

- This space lies between the parietal peritoneum and fascia transversalis which contains areolar tissue and fat.
- Coursing through this space are
    1) Inferior epigastric artery.
    2) Median Umblical ligament,a midline fibrous remanant of urachus.
    3) Medial umblical ligament,a vestigial remanant of fetal umblical arteries.
    4) Falciform ligament of the liver contain round ligament or Ligamentum teres extending from umbilicus to liver.

Vessels and Nerves of Abdominal Wall:

- Last 6 intercostal and 4 lumbar arteries,deepcircumflex iliac arteries,superior and inferior epigastric arteries supply anterolateral abdominal wall. (Fig VI)
- The main branch of intercostal and lumbar arteries along with ilioinguinal,intercostal and iliohypogastric nerves course between transverse abdominus and internal oblique muscle.
- The distal termination of these vessels pierce the lateral margin of rectus and anastomosis with branches of superior and inferior epigastric vessels.
- Deep circumfles iliac artery pierce abdominal muscles above iliac crest near anterior superior iliac spine.
- Venous drainage follows the course of arteries.Veins above umbilicus level grains into SVC and below it to IVC.
- Lymphatic follow the venous drainage and above umbilicus to axillary nodes and below umbilicus to superficial inguinal nodes.
- The Thoracic nerves 7 to 12 course between transverse abdominus and internal oblique and provide motor sensation to these muscles.
- Distal end of these nerve pierce rectus sheath medially to provide sensory innervation.
- Ilioinguinal and iliohypogatric nerves arise from 12^{th} thoracic and 1^{st} Lumbar nerves provide sensation to hypogatrium and lower abdominal wall.

- Iliohypogatric nerve pierces internal oblique and travels under external fascia to emerge in superior crus of external ring and provide sensory innervation to hypogastrium.
- Ilioinguinal nerve course along spermatic cord and emerges via external ring to provide sensation over skin of inguinal region and scrotum or labium.

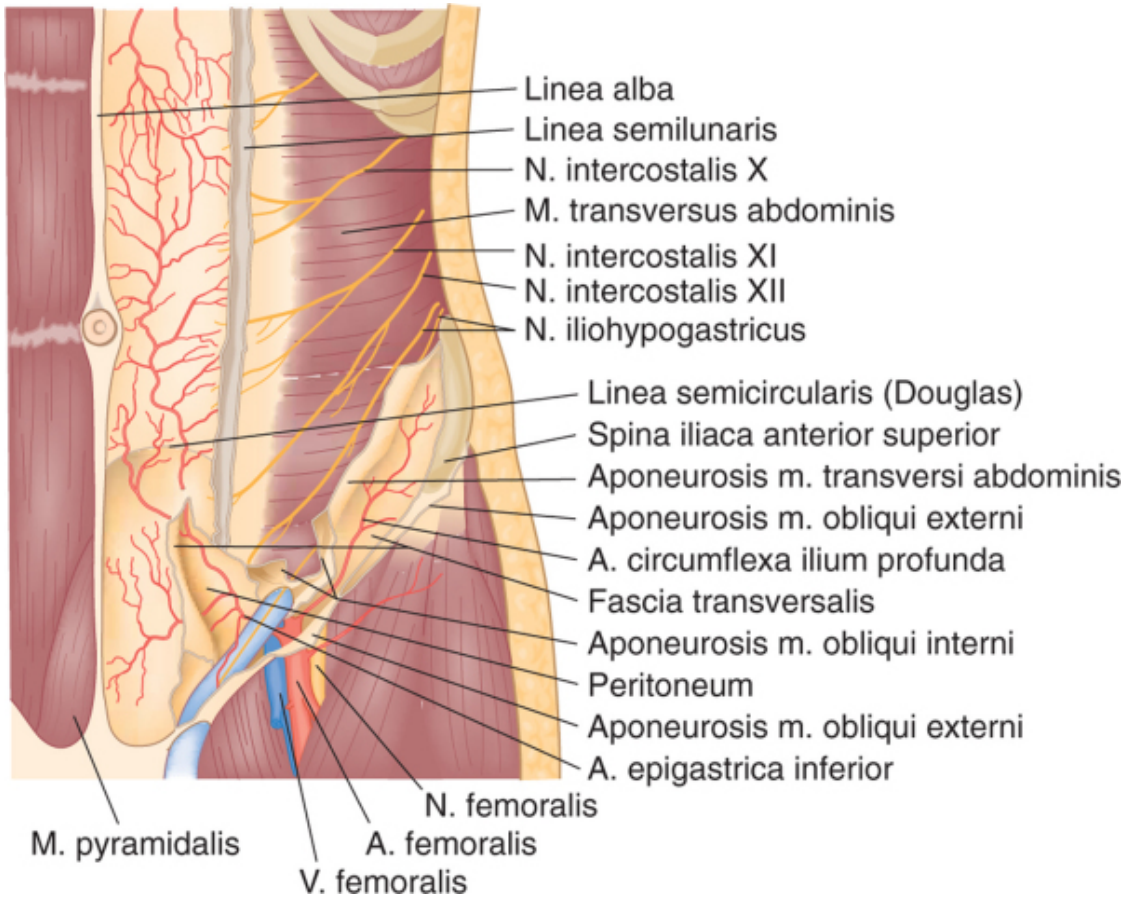


Fig VI. Arteries and nerves of abdominal wall

Ventral hernia:

- Ventral hernia is defined as a protrusion of abdominal contents through the anterior abdominal wall fascia.
- They are classified as spontaneous or acquired or by their location.
- Epigastric hernia are those occurring in midline between xiphoid process and umbilicus.
- Umblical hernias occurring within the umbilicus and hypogastric hernias which are rare and spontaneous occurring in midline below the umbilicus.
- Acquired ones are that typically occur after surgical incision and hence they are called incisional hernias.
- Diastasis recti are present as midline bulge though they are not true hernias as there was no defect in transversalis fascia.
- Here there was stretching of linea alba and hence bulge occurs medial to rectus muscle.
- Abdominal wall diastasis can also occur in other than midline.

Incidence:

- Based on the operative statistics, 15% to 20% of all abdominal wall hernias are due to incisional hernias.
- 10% of hernias are contributed by umblical and epigastric hernias.
- Incisional hernias are more common in females and twice that of males.
- So among 4 million laparotomies done in U.S 2% to 30% incidence of incisional hernias.
- Several factors both technical and patient related factors play important role in the development of hernias.
- There is no conclusive evidence that the type of suture material at initial surgery plays important role in development of incisional hernia.
- Patient factors such as male gender,obesity,emphysema,sleep apnea and prostatism are linked to the development of ventral hernia.
- Those factors which cause increased destruction of collagen can also cause collagen damage and leads to development of hernia.
- Wound infection an another important factor also plays important role in development of incisional hernia.
- Type of abdominal incision contributing to incisional hernia is still controversial.
- The incidence of ventral hernia in midline laparotomy incision are around 3% to 20%
- This incidence gets doubled if it is associated with surgical site infection.

- A meta-analysis including 11 studies showed the risk of hernias in different type of abdominal incisions.They are

  Midline : 10.5 %

  Transverse : 7.5 %

  Paramedian : 2.5%.

- Recent study showed that there was no difference in the development of hernias in midline and transverse incisions after 1 year.
- But wound infection rates are higher in transverse incisions.
- So while choosing incision its wise to choose incisions which gives good adequate exposure.
- Since there is no prospective randomized study of natural history of untreated asymptomatic ventral hernia most surgeons recommend repair of these hernias when diagnosed.

Incisional hernias:

- These are the abnormal protrusion of peritoneum via separation of the edges of musculoaponeurotic wound.
- The wound may be recent,fresh or even old.The hernial sac may or maynot contain viscus.
- Predisposing factors:
    1) Obesity
    2) Wound infection
    3) Wound dehiscence
    4) Type of incision
    5) Post operative hematoma or seroma.
    6) Poor technique of wound closure.
    7) Inadequate available abdominal wall.
    8) Post operative distension.
    9) Ascites secondary to liver cirrhosis.
    10) Malnutrition
    11) Concomitant steroid therapy.
    12) Chronic pulmonary disease and Diabetes mellitus.

- Incisional hernias occur in vertical incisions are due to contraction of muscles pulling apart the edges of wound.
- Wound dehiscence and hernia will occur soon in the absence of complicating factors if hernia has to occur.
- Normally abdominal muscles regain its preoperative strength within 8 weeks

Treatment of Incisional hernia:

Indication:

- They broadly cover two aspects
    1) To correct the prevalent problem.
    2) To prevent any hernia related problem in future.
- The common problem encountered are
    1)Pain,
    2)Obstruction of bowel
    3)Deformed abdominal wall,
    4)Ulceration over the skin
    5)Limitation in activities of daily living.
- Either is symptomtic or asymptomatic unrepaired VH will increase in size over the period of month to years.
- They then worsen symptom complex and slowly become more difficult to repair.
- As the complixity level of hernia increase there also decrease in expertise surgeon.

Surgery:

- The mainstay of treatment of ventral incisional hernia is operative 3 main classes of surgical repair has emerged.
- These include primary suture repair,open repair with mesh placement and laparoscopic repair.
- Major consequence of open/lap hernia repair of ventral incisional hernia is recurrence.
- The recurrence was around 25% in primary closure alone.

Primary suture repair:

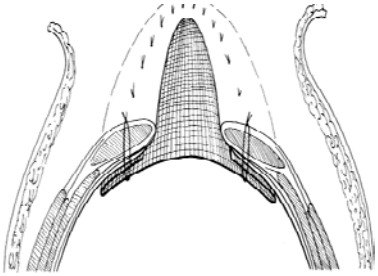
- They are generally done with hernia defects <4 cm in diameter.
- In addition there should be strong and viable surrounding tissue.
- In case of large defects or hernia associated with multiple small defects mesh repair is preferable.
- After general anaesthesia,skin incision is made over previous scar and sac separated from subcutaneous tissue and cleared off from fascial attachment.
- Then the fascia is also cleared off its soft tissue attachment 3-4 cms from its edge.
- The fascia is then approximated using interrupted suture with non absorbable suture.

- Care should be taken so that suture shouldnot create excessive tension.
- If there is large pocket in soft tissue above the fascia suction drain is advised to evacuate seroma.

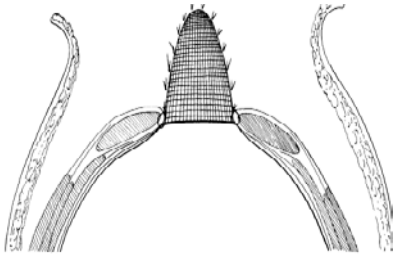
Mesh repair:

- Placing and suturing of sheets of nonabsorbable prosthetic mesh over the defect is widely practiced in modern era.
- Lower rates of intra-operative complication and lower recurrence rates are associated with mesh repair.
- Many variation in the techniques of VIH mesh repair has been described.
- Placing of mesh either intraperitoneal,extraperitoneal,retro-rectal or overlay technique are practiced.
- Skin incision encompassing previous scar so that removal of scar tissue is accompalished.
- The subcutaneous tissue is divided upto anterior fascia and sac is separated from underlying fascia upto 3-4 cms from the rim.
- After clearing of sac and its contents now mesh can be placed either intra-abdominally or extraperitoneally or anterior to fascia after primary closurof the defect if possible.
- In placing mesh intra-abdominally use of barrier coated mesh or composite mesh is advised to prevent adhesion of bowel to mesh.

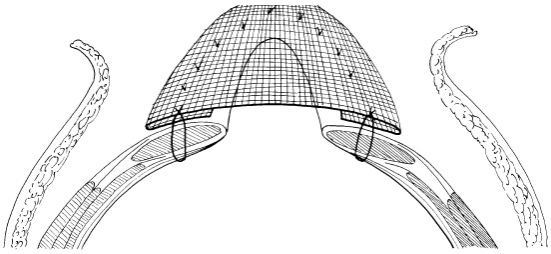
- Various techniques of mesh repair are shown in figure.



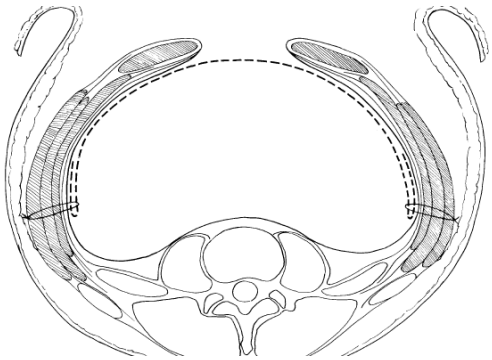
A) Underlay graft.



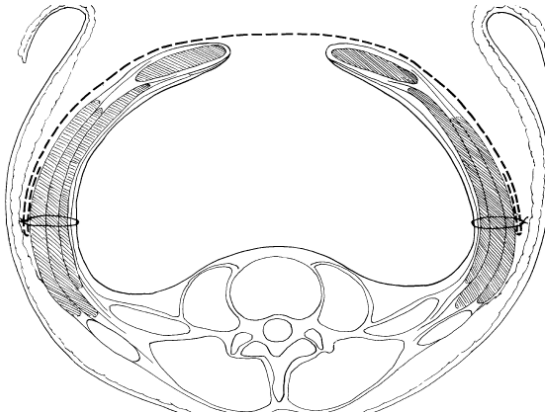
B) Inlay graft.



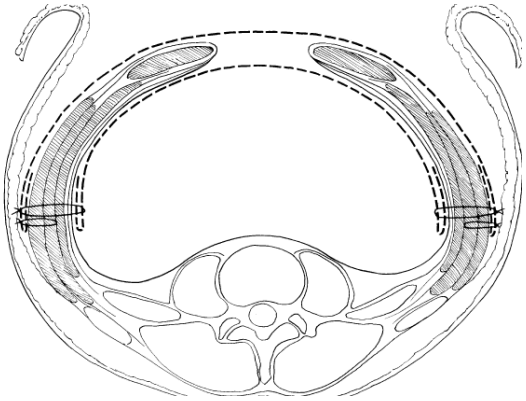
C) Overlay graft



D) Large underlay graft.



E) Large overlay graft



F) Both over and underlay graft.

Umbilical hernia:

- Umbilical ring in the linea alba forms Umbilicus.
- Ligamentum teres (round ligament) and Para umbilical veins join the umbilicus superiorly in the intra-abdominal region.
- Median umbilical ligament formed by urachus joins the umbilicus inferiorly.
- They are common and congenital in infants.
- They close spontaneously by the age of 2.
- If persists beyond the age of 3 they are surgically repaired.
- Umbilical hernias in children rarely complicates.
- Umbilical hernia in adults are usually acquired.
- These are more common in females and in patients with conditions causing increased intra-abdominal pressure such as pregnancy, chronic abdominal distension and ascites.
- Umblical hernias are frequently seen in patients with single Apo neurotic decussation at midline rather than three layers of lateral abdominal muscles.
- Rupture and strangulation can occur in chronic ascites conditions.
- Small asymptomatic umbilical hernias barely detected on clinical examination rarely needs repair.
- Adults with symptoms,incarceration,large hernias,thinning of overlying skin and associated with chronic ascites are need to be repaired.

- Spontaneous rupture leading to peritonitis and death occurs in umbilical hernias associated with chronic ascites.
- Classical umbilical hernia repair was proposed by Mayo using vest over pants repair.
- Here the superior and inferior fascial ridges are imbricated and since it has increased tension it leads to recurrence rate of 30%.
- Mayo repair are rarely practiced now and smaller defects are closed primarily after separating the sac from surrounding fascia.
- Prosthetic mesh was used in closure of defects larger than 3 cms.
- Preperitoneal bridging underlay mesh reinforced with suture overlying are also practiced
- Number of techniques followed in mesh repair of Umbilical hernia and none found superior to other.
- Laparoscopic hernia repair reserved for recurrent and large defect hernias.

Epigastric hernia:

- It is the defect in midline over the linea alba extending from xiphoid process superiorly to umbilicus inferiorly.
- Paraumblical hernia also comes under classification of epigastric hernia which slides along the edges of umbilicus.
- Incidence of epigastric hernia ranges from around 3-5% in general population.
- They are mostly diagnosed at middle age since congenital ones are uncommon.
- Male to female ratio is of 3:1.
- Etiological factor includes weakened midline fibres due to lack of decussating midline fibers and increased intra abdominal pressure.
- The defect is usually elliptical transversely and mostly are smaller ones as larger defects are rare.
- In majority of cases the defect is filled only by preperitoneal pad of fat and definite peritoneal sac would be lacking.
- In cases containing peritoneal sac usually that involves omentum only and rarely small intestine.

Clinical manifestation and treatment:

- Epigastric hernia mostly asymptomatic and represents accidental finding during examination.
- In symptomatic cases they represent with vague abdominal pain which is aggravated by standing and straining and relieved by rest.
- Sudden and severe pain may be associated with strangulation or incarceration of omentum or periperitoneal pad of fat.Bowel strangulation is a rare finding.
- It is diagnosed on examination as soft,reducible mass in midline superior to umbilicus.
- Difficulty encountered in obese patients and hence in such cases radiological investigation esp.CT abdomen is preferred.

Treatment:

- Usually small defects are closed using local anaesthesia as day care procedure.Larger ones need general anaesthesia to repair.
- Technique is similar to other VH repair after midline incision the subcutaneous fat is cleared off sac if present is identified reduced into the abdomen.Alternatively large sac can be excised before closing the defect.
- Defect is closed transversely and can be reinforced with PP mesh but usually not necessary as recurrence at same site is rare following primary closure

Choice of mesh:

- Despite understanding well of abdominal wall anatomy progress of aseptic technique,prophylactic antibiotic and refined surgical skills recurrence from anatomical repair was still high.

- Primary repair of ventral hernia had 63% recurrence rate around 10 years.

- In such cases if prosthetic mesh was used recurrence rate drops to around 32%.

- If hernia is <10 sq.cm the recurrence without mesh would be 67%.

- If in such cases repair done using mesh the recurrence rate drops 17%.

- Phelps (1894) First used man made prosthetic material for hernia repair.

- Francis Usher(1958) created revolution in prosthetic materials used in hernia repair.He first used Polypropylene mesh.

Ideal Mesh :

An Ideal mesh should have the following characteristics.

1) Non-carcinogenic.
2) Can be handled easily.
3) It has to be strong to prevent recurrence.
4) Economical.
5) Easy to manufacture.
6) More biological- Less host inflammatory response.
7) In case if it get infected it should be treatable.
8) Cannot be detected by patient or by clinical examination.
9) Future abdominal surgery should be possible.
10) Should not be allergenic or hypersensitive.

Of many types of non biological mesh introduced only three have stood the test of time.They are

- Polypropylene.
- Polyster.
- Polytetrafluoroethylene (PTFE).

Polypropylene:

- It is a polymer with hydrogen and methyl group attached to carbon backbone.(Fig VIII)
- The tertiary carbon can undergo oxidation which can lead to oxidation of carbon backbone.
- This clinically leads to decrease in mass and diminished compliance.
- These are manufactured into knits or weave with different densities and patterns.
- Absorbable materials are incorporated to give stiffer feel and good handling character for implantation which later become pliable as the absorbable material degrades in the body.

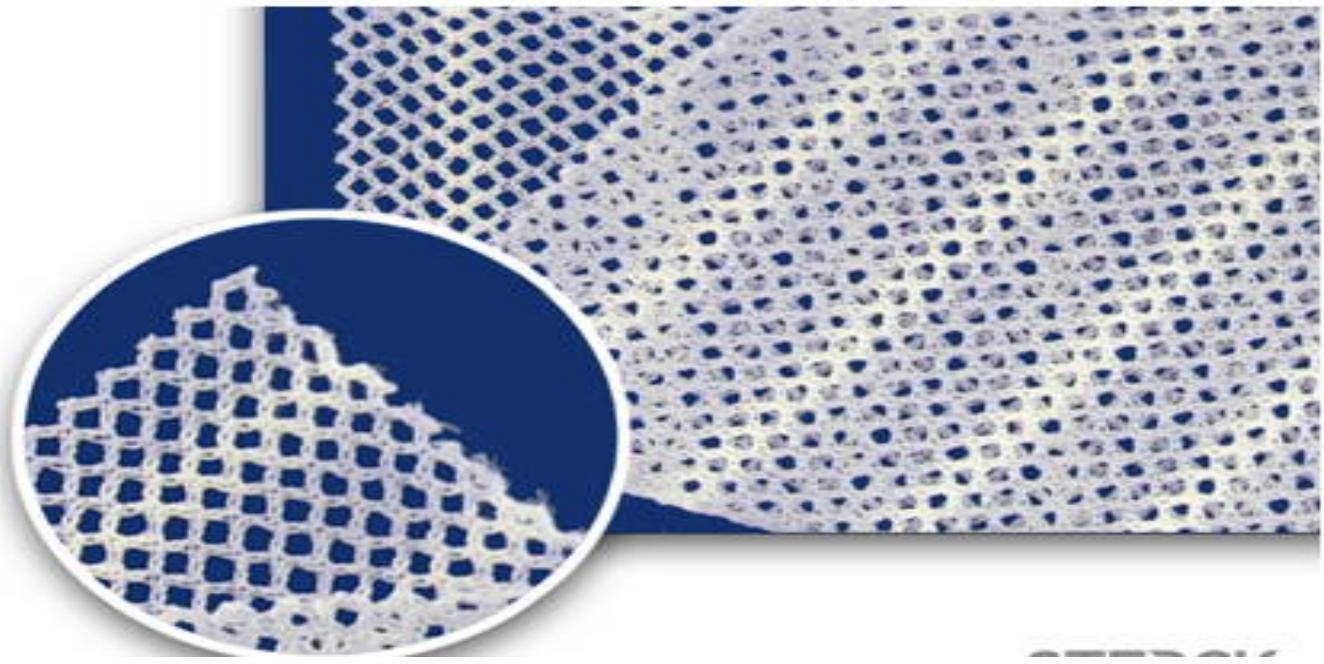


Fig VIII. Polypropylene mesh

Polyster:

- It is a polymer of oxygen and carbon backbone.
- Hydrogen and oxygen atoms are attached to it.
- Poly ethylenr terephthalate (PET or Dacron) is the most commonly used among various available mesh.
- They are hydrophilic and hence undergo hydrolysis while polypropylene are hydrophobic undergoes oxidation.
- In general they tends to have less tissue adherence,scar contraction and feels softer then polypylene.

Fig (VII) Polyster mesh

Polytetrafluoroethylene (PTFE) :

- Here the carbon backbone attached to polymer of Fluorine.
- Teflon and core-Tex are the common commercially used mesh.
- Since Fluorine-Carbon bond is one among strongest bond they resist degradation by tissue enzymes and microorganisms.

Expanded PTFE (ePTFE) :

- They are designed with very tiny holes on one side and large holes on the other side within which tissue can grow.
- Their tiny pore size means they have poor performance in the presence of infection.
- Polyster and polypropylene perform well in contaminated region but not this one.
- ePTFE are usually removed if infection sets in or if it is exposed.
- They also prone for encapsulation and seroma formation.
- Another advantage of tiny pore composition is that it doesnot leads to adhesion.

Barrier-coated Meshes:

- Keeping intraperitoneal mesh for repair of ventral hernia is like doing two_sided task.
- On one side the mesh has to get incorporated into the abdominal wall without changing mesh edifice with maintenance of its mechanical properties and prevent recurrence.
- On other side it has to prevent the adherence of intra-abdominal contents to the mesh and has to form neoperitoneum without any adhesion.
- 'Bard composix'- ePTFE on onside and polypropylene on other.(Fig IX)
- 'Proceed mesh' – Polypropylene mesh with oxidized regenerated cellulose barrier.
- 'Supramesh' –Polypropylene with hyaluronic acid and carboxymethyl cellulose.
- 'Parietex' – Polyster with polyethylene glycol glycerol co activity
- 'C-QUR' – Polypropylene with Omega-3 fish oil which break down in about 6-month period after neoperitoneum formed.(Fig X)

Fig IX. Brad-composix

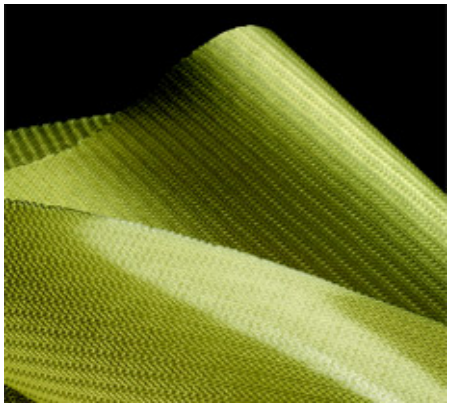


Fig X. C-QUR Mesh

Selecting Optimal Mesh:

- Location of use whether intra or extra-peritoneal.
- Method of implantation - In open repair stiff mesh can be used but in case of laparoscopic repair the mesh not affected by rolling and easy to spread after placing are important.
- Hernia repair characteristics - Light weight mesh which has less foreign boby reaction and flexibile also forms scar net instead of scar plate,less mesh erosion and less long term pain.
- In reinforcing fascial closure light weight mesh is used and in bridging large gap and in morbidly obese patients heavy weight mesh is used.
- Clinical efficacy – Recurrence,chronic pain, abdominal wall compliance and mesh erosion are to be considered.Optimal aim is restore a functional abdominal wall.
- Enterocutaneous fistula is the serious complication in case of Polyster (15.6%) and Polypropylene(1.7%) meshes where prolene and ePTFE meshes had none.
- Cost and availability factor are also taken in consideration.
- Patients cultural and religious background are important in using biological meshes.
- Field of placing mesh also an important consideration as biologic meshes are unsuitable for grossly contaminated wounds.

Mesh related complications:

- Mesh related complication are broadly classified into mesh related non infectious complication and infectious complication.

Mesh related non-infectious complication:

- Advanced research in biomedical material ndustries leads to development of relatively inert and biocompatible meshes.
- Despite these advances meshes when implanted trigger various host response in human body.
- They include inflammation(called as foreign body reaction), fibrosis, thrombosis, calcification and infection.
- Foreign body reaction is the process of attachment of proteins such as albumin and fibrinogen to the surface of polymer.
- These proteins then degrade due to physiochemical properties of each polymer.
- This in turn attract and stimulate macrophages which in turn release inflammatory infiltrates and growth factors.
- These inflammatory cells which are attracted to polymer leads to formation of granuloma.
- These granuloma leads to increased cell turnover and continue over several years after mesh implantation.

- FB reaction leads to seroma, rejection,adhesion,migration of mesh and pain as clinical manifestation.
- Most meshes made of non-absorbable polymer which are most of used in surgical practice.
- Mesh made of absorbable polymer induce less foreign body reaction and adhesion.
- Hence newer meshes are made of both absorbable and non-absorbable polymers combined.

Mesh Infection:

Introduction:

- Its is the major device related complication following VH mesh repair.
- Mesh infection offers greatest challenge for treating surgeon.
- Ideal characteristic of any mesh are resistant to infection.
- But in most of the cases such ideal property doesnot exists.
- In most cases the diagnosis of mesh infection was challenging since there lacks a definitive diagnostic criteria.
- In many published reports mesh infection rate ranges around 5 %.
- Since most of literature describes surgical site infection and scarce data on VH mesh infection,true incidence still can be higher.
- Mesh infection also occurs in concordance with surgical site infection.
- They can also associated with superfiscial,deep or organ/space surgical site infection and more often with deep or organ/space infections.
- Mesh infection leads to increased morbidity to patient and deleterious to health care system as they increase reoperation and cost of care.

Incidence of mesh infection:

- The incidence of infection following VH repair with prosthetic mesh increases when compared to anatomical repair alone in both simple and complex hernia's.
- Another study revealed size of hernia defect plays important role (i.e) Increased infection rate with defect >10cms in size.
- Incidence of VH mesh repair infection ranges around 8%.
- The rate of infectious complication increased in patients with diabetes,immunocompromised or obesity.
- It also influenced by surgical techniques and type of mesh used.
- So the incidence is lower in laproscopic repair group compared to open VH repair.
- So on counting for the type of mesh,polyfilament polyster mesh had more incidence of infection,small bowel and EC fistula formation than other type of mesh used.
- Microporus mesh had higher infectious complication rate while macroporus had higher incidence of adhesion and erosions.
- Therefore the rate of mesh removal in laparoscopic VH repair was higher following infection due to common use of ePTFE mesh.

Clinical Symptoms and signs:

- The time interval between VH mesh repair and onset of mesh infection ranges between 2 week to 39 months.
- Evidence of local signs of inflammation (Pain,erythema,swelling,tenderness and rise in temperature over the abdominal wall in area containing mesh).
- Systemic manifestations including fever,malaise,chills or rigors.
- Leukocytosis,elevated sedimentation rate,signs of sepsis.
- Differentiating superfiscial skin infection from mesh infection is important.
- Few patients present with localized abscess without systemic manifestation.

Diagnosis:

- Distinguishing early mesh infection from superfiscial SSI to be done.
- Unlike mesh infection SSIs sometimes treated with local debridement,dressing and antibiotic alone.
- They can present as infected seromas which can be distinguished from non infective seromas by fluid culture.
- Hence actual diagnosis to be established only by taking deep culture or culture directly from mesh itself.
- Technique used in VH repair gives the diagnostic clues.

- Purulent discharge emantes from incision site after open repair while it occurs at port site in laparoscopic repair.
- Radiological imaging shows fluid collection around the mesh,flecks of gas identified in some cases.
- So the best diagnosric method is culture and gram staining from the fluid aspirated deep surrounding the mesh.

Time line in mesh infection:

- Occurrence of mesh infection has bimodal distribution.
- Infections occurring within fewdas of surgery are more likely to be linked with EC fistula or incisional SSI.
- Even cases there was no bowel injury most infections present months after surgery.
- Studies done by Jezupous and Cobbs on open VH repair with PP mesh shows average of 11.3 months for the onset of infection.

Microbiology of Mesh infection:

- Most commonly implicated organism in mesh infection is Staph.aureus.
- Staph epidermis,Enterococcus,Streptococcus pyogens,Klebsiella and even Aspergillus has also been reported.
- About 81% of the infection are due to S.aureus,17% by gram negative such as Klebsiella and proteus.
- MRSA contributes 52% of S.aureus infection.
- Enteric gram negative organism such as E.coli are also seen when repair done along with enterostomy or other GI procedures.
- Bacterial adherence to mesh is prerequisite factor to produce infection.
- Biofilm or polysaccharide formation is the important process and unique in that bacteria will adhere to any indwelling medical device to its structural matrix including meshes.
- Bacteria in biofilm behave differently than their free forms.
- These groups can lie in dormant form for many years.
- They also resistant to action by antibiotic since they are not actively dividing.
- In biofilm they can survive antibiotic concentration as high as 1000-1500 times that tolerated by free forms.

Etiology of mesh Infection:

Patient and Hernia related factors:

- There is inconsistent association between patient related factors and mesh infection.
- Many studies revealed only BMI is significantly associated with mesh infection.
- Another study revealed COPD is associated with deep infection.
- Other factors such as diabetes,tobacco smoking,corticosteroids intake,long operating time,absorbable mesh usuage are predictors of SSI not significantly associated with mesh infection.
- The risk of developing mesh infection following SSI are still unclear.
- In one study mesh infection are reported in patients developing deep SSI.

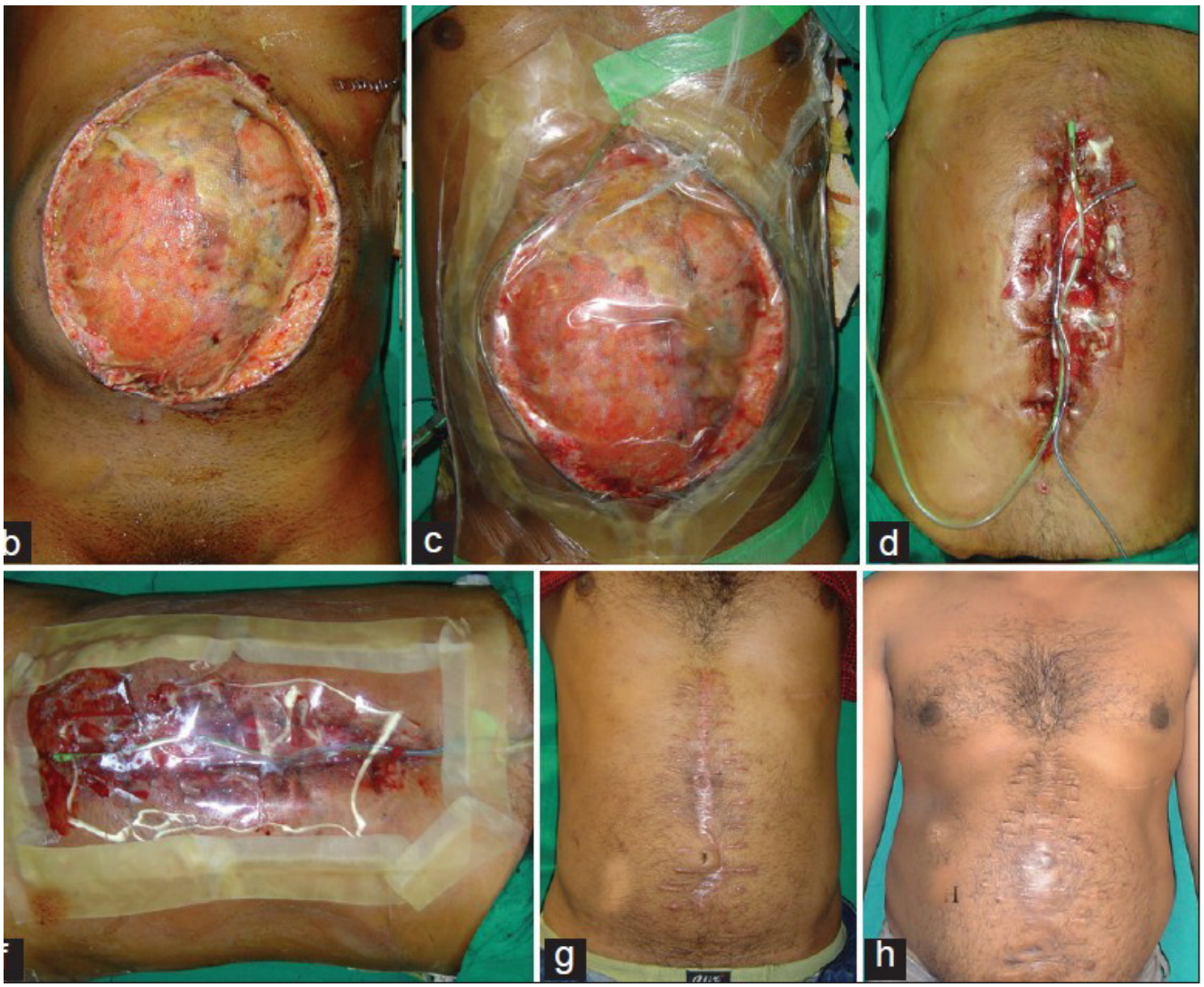
Mesh Factors:

- In a study heavier meshes has higher incidence of infection (14.5%) than lighter ones.
- Another study revealed larger size mesh increases risk of infection.
- More over ePTFE mesh has higher infection rate (1.7%) compared to PP mesh.
- Necessity for removal of PP also infrequent following infection and hence only <0.7 % of cases with PP mesh infection required removal.
- So in case of clean contaminated surgery PP meshes can be safely used.

- This was due to the fact PP mesh gets well incorporated into anterior abdominal abdominal wall with in 2 week of implantation.
- They allow macrophages and leukocytes between the filaments due to this large pore size.
- Multifilament mesh theoretically had increased risk of bacterial attachment than monofilament mesh.

Technical factors:

- Both open and laparoscopic mesh repair had chance of infection.
- Incidence following open VH repair ranges 6-10% where lap repair has 0-3.6%.
- Addition procedure involving bowel through the same incisions increased chance of infection(52%).
- Longer time of surgery also had role but still it is controversial.
- Inlay mesh has lower incidence of mesh infection and removal than overlay mesh.



Picture showing mesh infection and staged treatment procedure with vacuum assisted dressing leading to closure of wound.

Treatment of Mesh infection:

- As soon the mesh infection suspected following ventral hernia repair especially if associated with wound infection the wound infection should be treated appropriately.
- Culture from infection site can be helpful to formulate antibiotic but its use in SSIs are still doubtful.
- Definite treatment for mesh infection depends on condition of patient if patient present with sepsis then explantation procedure is deferred and drainage of prulent collection is first carried out.
- Later once the patients condition is stabilized definite procedure can be undertaken.
- With recent studies mesh explantation is deferred till other mode of conservative treatment fails and mesh salvage is widely practiced
- But in case of ePTFE mesh there was high rate of failure with conservative managaement and mesh explantation rate was also higher in that group.
- In cases were mesh removal done further treatment options include either primary skin closure, autologous grafting,delayed closure following wound debridement.
- If resurgery for mesh repair then its better be delayed for 6 to 9 months.
- In most cases resolution of mesh infection occurs after an average of 6.9 months.

Prevention of Mesh infection:

- With proper adherence to recommendation by Surgical care improvement project Such as adherence proper antiobiotic prophylaxis one hour before surgery,clipping of hairs just prior to surgery if necessary and prevention of hypothermia reduces surgical site infection.
- If prior episode of surgical site infection was found prior tissue culture for microorganism are done before hernia repair.
- In Some cases the procedure can be differed till the resolution of infection.
- Intra operative precautions that reduce the incidence of mesh infection include avoidance of contact of mesh with skin,placing mesh intraperitonealy via trocar and not through abdominal wall,saline washing of wound after raising flap in case of open repair and changing glove while handling mesh.
- In case of potentially infected hernia repairs such as previous SSIs,violation of gastrointestinal tract and presence of Stoma use of biological mesh was advised.

Antibiotic prophylaxis in Ventral hernia repair:

- Since there is lack of high quality studies in ventral hernia the evidence of antibiotic prophylaxis and its use was still lacking.
- Rios et al study done on 216 patients showed antibiotic prophylaxis considerably reduced incidence of mesh infection among experimental group.
- Another RCT compared patients with and without antibiotic prophylaxis and shows 44% in no antibiotic group developed SSI while only 6% in antibiotic group developed SSI.
- Few advice a week course of antibiotic postoperatively but this was not supported in further studies.

Antibiotic impregnated mesh:

- Silver/Chlorhexidine was impregnated in ePTFE mesh found more effective in preventing mesh infection compared to ePTFE mesh alone.
- In one study it was revealed that antibiotic coated ePTFE has lower bacterial count after 5 days of implantation.
- An experiment with inoculation of MRSA into nine type of meshes only ePTFE plus found to be bactericidal.
- Lysostaphin a novel antimicrobicidal was found to be active against staph.aureus was coated in mesh to prevent staphylococcal infections.
- On use of biological mesh as it is absorbable in contaminated fields it can be safely used.
- There is no need for removal mesh incase of mesh infection but only hindering factor was its cost.
- Its long term durability following debridement was still doubtful.

MATERIALS AND METHODS

PLACE OF STUDY:

ALL SURGICAL UNITS OF DEPARTMENT OF GENERAL SURGERY, STANLEY MEDICAL COLLEGE AND HOSPITAL

DURATION:

Jan 2013 to Nov 2013

STUDY DESIGN:

PROSPECTIVE STUDY

PATIENT SELECTION:

1) All patients undergoing Ventral hernia mesh repair who developed mesh infection within 10 months .
2) Patients who are positive for bacterial culture from the DT fluid or from seroma around mesh.
3) Swab positive for culture taken directly from mesh in case of wound dehiscence and exposure of mesh.
4) Patients recovered from early post op period without any complication but developed mesh infection within 10 months

EXCLUSION CRITERIA:

1) Mesh repair done in patients who developed obstruction/strangulation of bowel /underwent resection anastomosis.
2) Patients with only surgical site superfiscial infection without involving deeper structures.
3) Patients lost follow up within the time frame of study period (10 months).

METHODOLOGY:

Patients with uncomplicated ventral hernia(Incisional/Epigastric/Umblical hernia) undergoing mesh repair (open/laparocopic. Inlay/overlay tecnique) in our Govt.Stanley Hospital who developed mesh infection within 10 months were enrolled in the study.Type of mesh used was not selected as criteria in segregating the patient group.

All patients were operated with adherence to strict guidelines from Surgical Infection prevention project (Antibiotic prophylaxis given within 1 hr of skin incision and stopped 24 hrs after surgery).

All patients invariably enrolled in study or not, drainage fluid for bacterial culture and sensitivity was sent on 1st post op day.Patients who are positive for bacterial culture and subsequently developed wound infection were enrolled in the study.

Patients with negative for culture on first POD and positive for DT fluid on 4th POD and swab culture taken directly over the mesh in case of wound dehiscence are also enrolled for the study.

Patients who recovered without any complication and discharged from our hospital but subsequently developed wound discharge or sinus with positive for bacterial culture within 10 months.Culture was taken from the deep seated seroma/purulent material directly over mesh or from sinus discharge if it has communication with layer where mesh was fixed.

PROFORMA

- NAME : SL. NO:
- AGE /SEX:
- ADDRESS WITH CONTACT NUMBER:
- IP NO:
- DATE OF ADMISSION:
- DATE OF SURGERY:
- DATE OF DISCHARGE:
- DURATION OF HOSPITAL STAY:
- DIABETIC STATUS:

HISTORY OF PRESENTING ILLNESS:

- Swelling :
    - Onset-
    - Duration-
    - Progress-
    - Any increase in size of the swelling during straining-
- Pain :
    - Site-
    - Duration-
    - Nature-

- Aggravating/relieving factors-

PAST HISTORY:

WHETHER A KNOWN CASE OF

DM/HYPERTENSION/ASTHMA/TB/EPILEPSY/CARDIAC ILLNESS

H/O SIMILAR EPISODES IN THE PAST, IF ANY:

H/O ABDOMINAL SURGERIES IN THE PAST, IF ANY/POST OP COURSE

H/O MAJOR ILLNESS/ HOSPITAL ADMISSIONS, IF ANY

PERSONAL HISTORY:

Whether a smoker or an alcoholic,

FAMILY HISTORY:

TREATMENT HISTORY:

<u>CLINICAL EXAMINATION:</u>

GENERAL EXAMINATION:

SYSTEMIC EXAMINATION:

CVS

RS

PER ABDOMEN

CNS

LOCAL EXAMINATION:

SWELLING

Inspection :

Site/Size/Shape/Margins/Sinus,Scars,Ulceration/Signs of Inflammation/Visible pulsation/Peristalsis.

Palpation :

Above findings/Consistency/cough impulse/Head-Leg rising test for increase or decrease of size of swelling.

Appx Size of Underlying defect:

CLINICAL DIAGNOSIS:

INVESTIGATIONS:

- UPPER GI ENDOSCOPY
- COLONSCOPY (If warranted)
- ULTRASOUND ABDOMEN
- ROUTINE INVESTIGATIONS(CBC,RFT,CXR,ECG)
- FBS/PPBS (In case of diabetic patients)

FINAL DIAGNOSIS:

SURGERY DONE:

OPERATIVES NOTES:

POST OPERATIVE EVENTS

Culture & Sensitivity

Drainage tube fluid :

Day : Result:

Wound swab :

Day: Result:

Swab from mesh (in case mesh was exposed) :

Day : Result:

FOLLOW UP:

Days after surgery developed infection :

Culture and Sensitivity report :

Results and Observations

All the patients who are developing mesh infection following ventral hernia mesh repair from Jan 2013 to Nov 2013 are enrolled as per inclusion criteria mentioned above.The study consisted of 53 patients from all surgical departments in Stanley medical college.A specified profoma was used to record patients information and was summarized in the materchart attached with it.The statistical inference was obtained and presented as graphical representation below.

The following topics were discussed

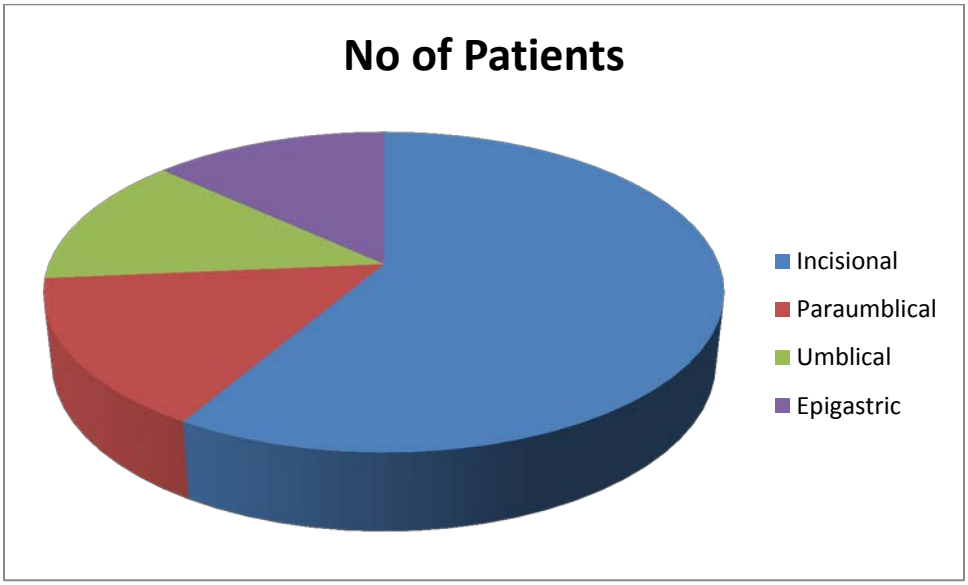
1) Proportion of each type ventral hernia.
2) Co morbidities of Patients associated with mesh infection.
3) Duration of onset of mesh infection.
4) Type of Microorganisms causing mesh infection in diabetic and non diabetic groups.
5) Antibiotic sensitivity of those common organisms between these 2 groups.
6) To arrive at a conclusion about starting appropriate antibiotic prophylaxis before surgery and empirical antibiotic following suspected mesh infection.

Among various ventral hernia repair the proportion of each type in our study group is calculated and tabulated here.

Table : 1

Type of Hernia	No of Patients	Percentage
Incisional	31	58.4
Paraumblical	8	15
Umblical	7	13.2
Epigastric	7	13.2

Graphical representation:



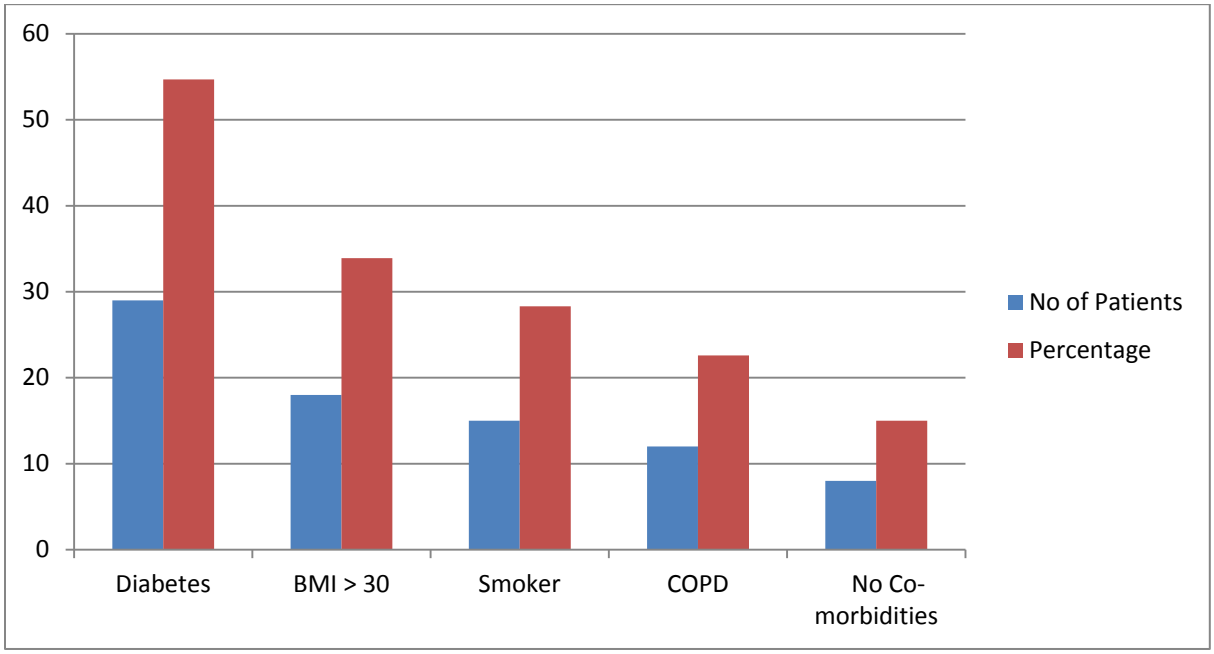
From our study we found incisional hernia was common among other ventral hernias and contributes 58% followed by paraumblical hernia.Umblical and epigastric hernia contributes equal proportion of our cases.

Co-morbidities of patients associated with mesh infection :

Table : 2

Co- morbidities	**No of Patients**	**Percentage**
Diabetes	29	54.7
BMI > 30	18	33.9
Smoker	15	28.3
COPD	12	22.6
No Co-morbidities	8	15

Graphical inference of Table 2:



From above graph we come to know the commonest co morbid condition associated with mesh infection in our hospital was diabetes (54%) followed by obesity,smoking and COPD.

Patients with no comorbidity are those without any of above comorbidity and they contribute only 15%.

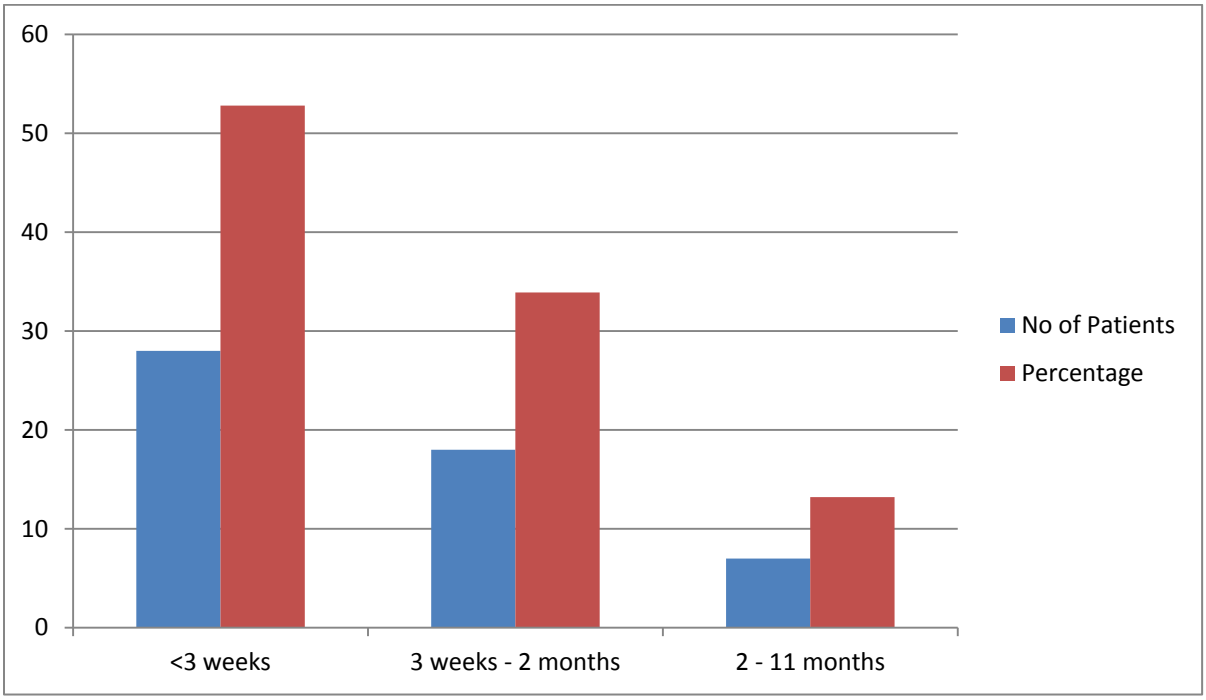
Note: Here each patients also has one or more comorbidities associated with them but classifying each of them is beyond our scope of the study.

Duration of onset of mesh infection are calculated and tabulated here.

Table: 3

Duration of onset of mesh infection	**No of Patients**	**Percentage**
<3 weeks	28	52.8
3 weeks - 2 months	18	33.9
2 - 11 months	7	13.2

Graphical inference of Table 3:



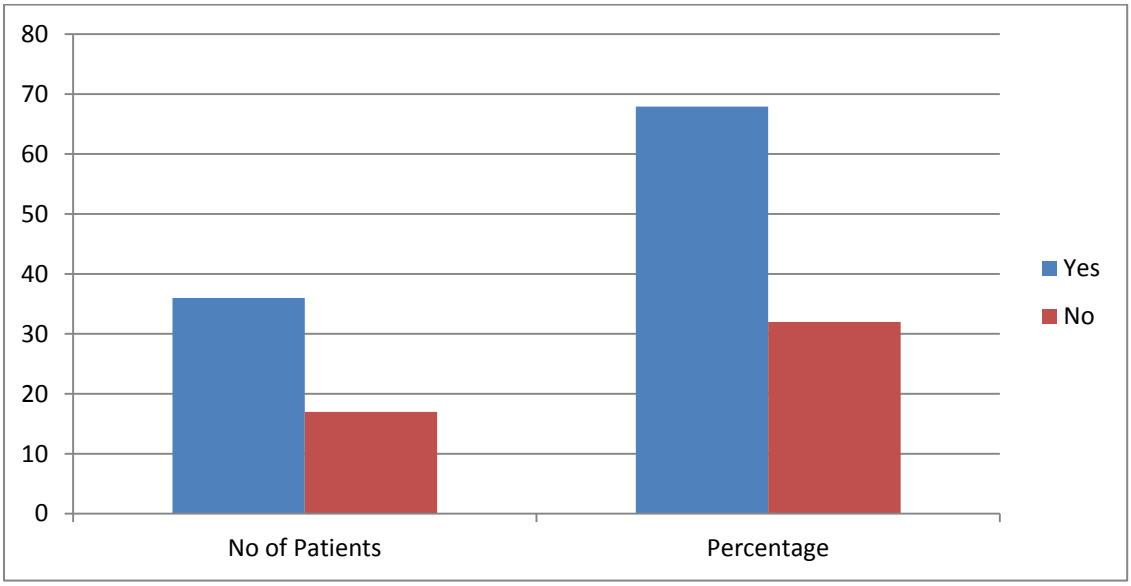
In our study most of the infection of mesh occurs with 3 weeks duration followed by later.Infections detected after 11 months duration was nil as most of them haven't turned up within the duration of study period.The onset of mesh infection in most of our study group is preceeded by surgical site infections which was represented in following graph.It also depends on the type of infective organisms.

Relation of Mesh infection with Surgical site infection:

Table 4.1

Surgical site infection	No of Patients	Percentage
Yes	36	67.9
No	17	32

Graphical inference:



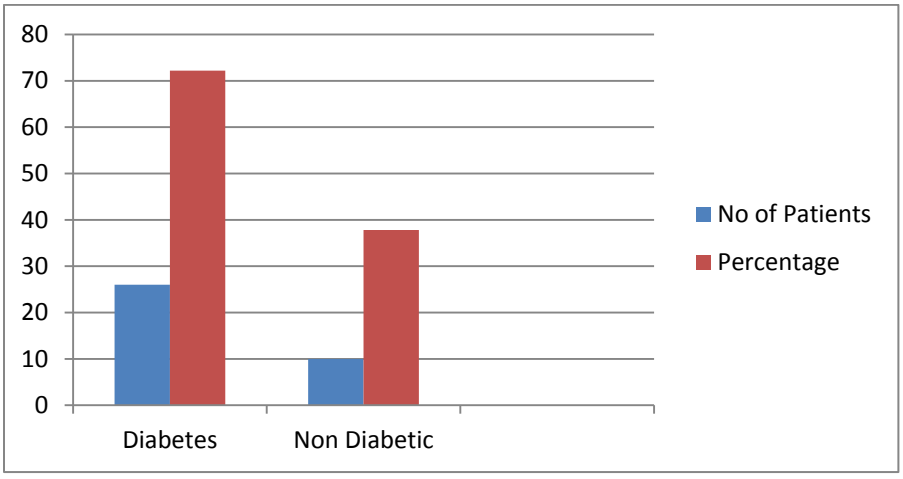
This graph represents association of SSIs with mesh infection as the mesh infection following SSIs was as high as 68% it clearly indicates in our study surgical site infection has an important role in mesh infection.The following table explains the proportion of diabetic patients developing mesh infection following wound infection.

Proportion of Patients with Wound infection developing mesh infection in diabetic and non diabetics:

Table :4.2

Surgical site infection	No of Patients	Percentage
Diabetes	26	72.2
Non Diabetic	10	37.8

Graphical inference:



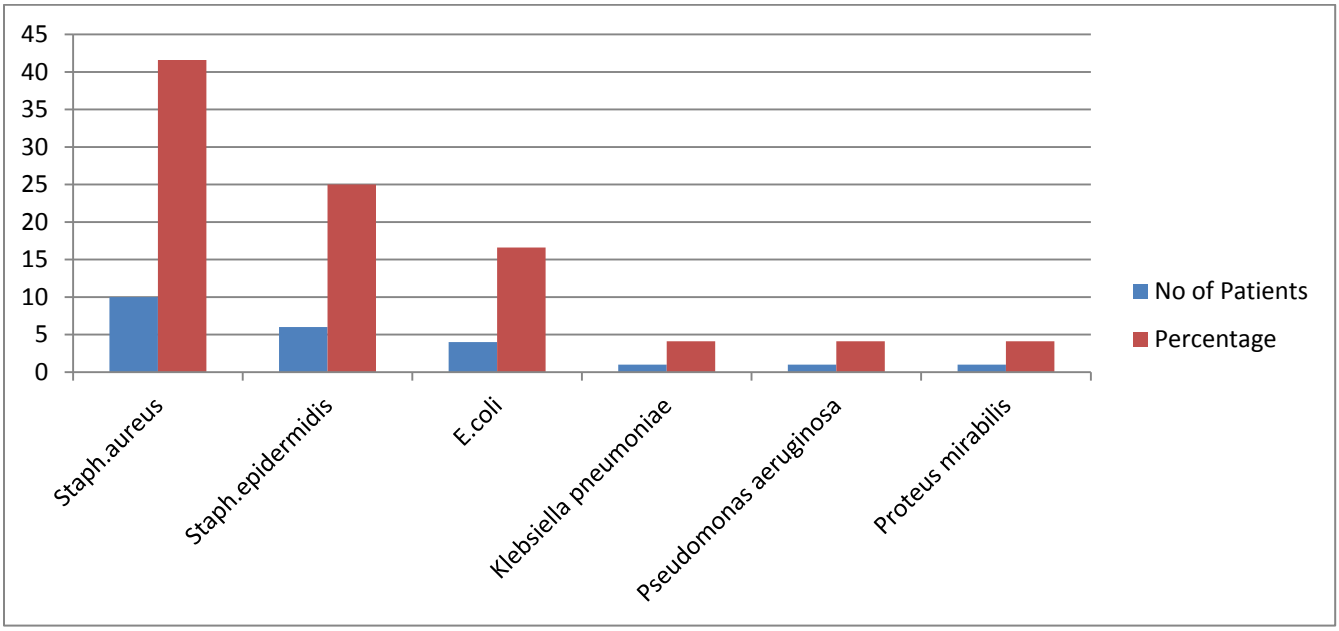
The above percentage was derived from total no of patients developing mesh infection along with wound infection.As the wound infection was high in diabetic group which in turn directly contributes to wound dehiscence and mesh exposure and infection.

Common organisms found in culture of non diabetic patients and the results are tabulated:

Table: 5

Organisms	No of Patients	Percentage
Staph.aureus	10	41.6
Staph.epidermidis	6	25
E.coli	4	16.6
Klebsiella pneumoniae	1	4.1
Pseudomonas aeruginosa	1	4.1
Proteus mirabilis	1	4.1

Graphical inference:



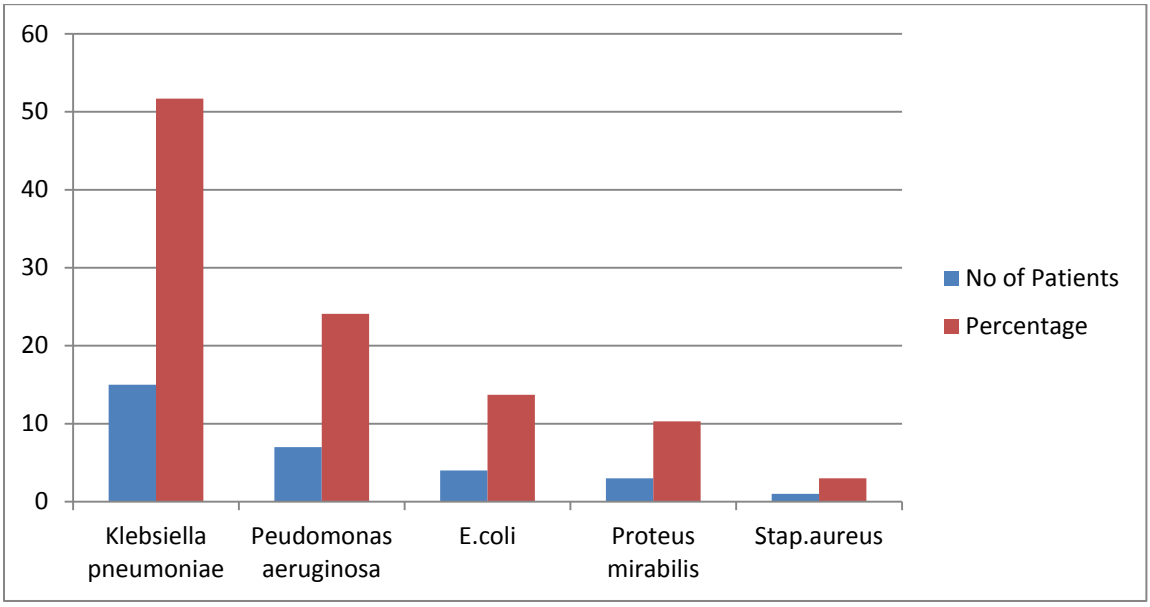
From above graph we can come to conclusion Staph.aureus was most common organism causing mesh infection among non diabetic group (42%) followed by Staph.epidermidis,E.coli,Klebsiella,Pseudomonas and Proteus.The same was done for diabetic group which was shown in following table.

Common organism found in culture of Diabetic patient and results are tabulated:

Table : 6

Organisms	**No of Patients**	**Percentage**
Klebsiella pneumoniae	15	51.7
Peudomonas aeruginosa	7	24.1
E.coli	4	13.7
Proteus mirabilis	3	10.3
Stap.aureus	1	3

Graphical inference:



From above graphical representation it shows Klebsiella pneumoniae was most common organism causing mesh infection in our study group followed by pseudomonas and E.coli.To note here staph.aureus which was common among non diabetic was least contributor in diabetic patients.

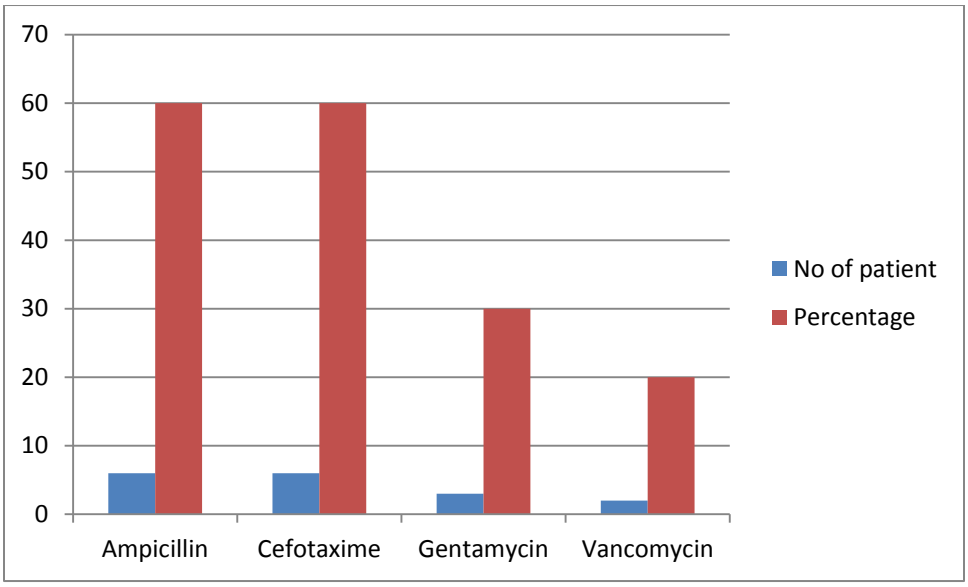
(Note: Cultures are taken from deep seated seroma either via drainage tube or directly over the mesh when it is exposed.)

Antibiotic sensitivity of the organisms which commonly causing mesh infection among Diabetic group of patients:

I) Staphylococcus aureus (Table 7.1)

Antibiotic	No of patients	Percentage
Ampicillin	6	60
Cefotaxime	6	60
Gentamycin	3	30
Vancomycin	2	20

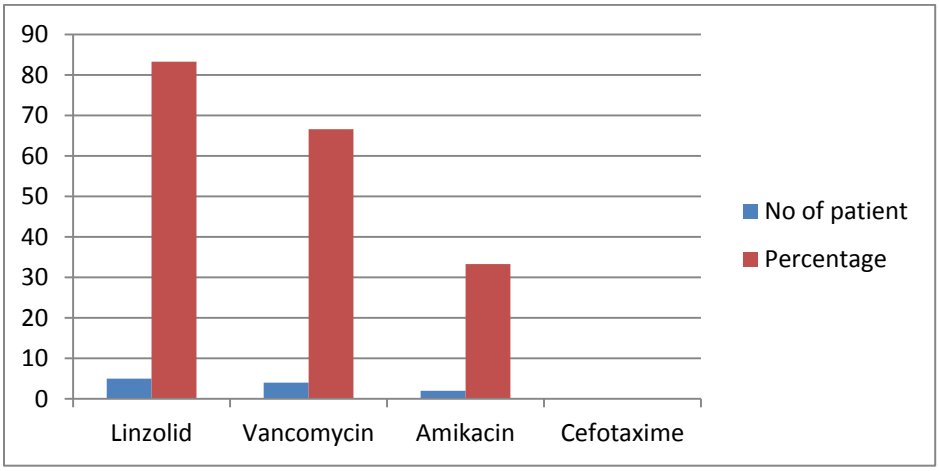
Graphical inference:



II) Staphylococcus epidermidis (Table 7.2)

Antibiotic	No of patient	Percentage
Linzolid	5	83.3
Vancomycin	4	66.6
Amikacin	2	33.3
Cefotaxime	0	0

Graphical inference:



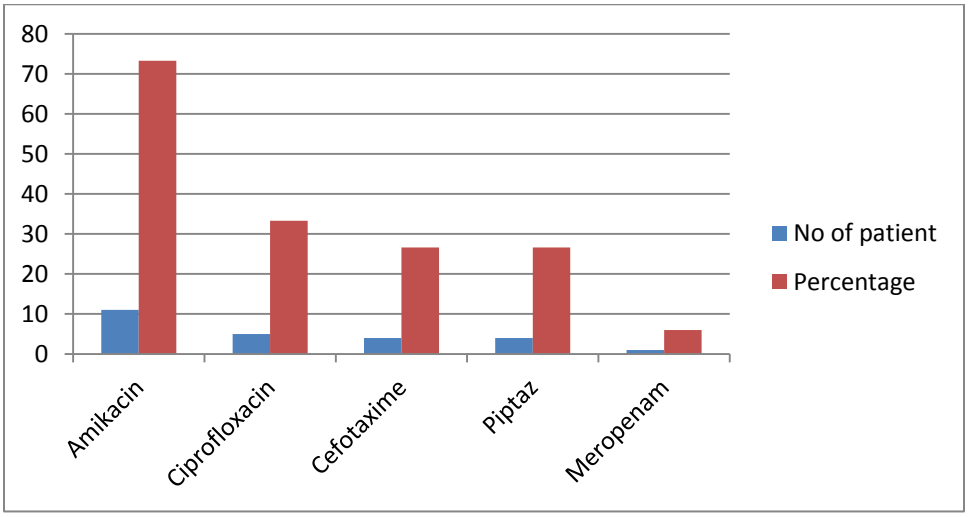
In non diabetic patient developing mesh infection which is most commonly caused by Staph.aureus which was equally sensitivite to both cefotaxime and ampicillin and second common organism staph.epidermidis was sensitive to Linezolid and vancomycin more or less equally. Since infection caused by latter only in small number it may not be significant statistically.

Antibiotic sensitivity of the organisms which commonly causing mesh infection among Diabetic group of patients:

I)Klebsiella pneumonia (Table 8.1)

Antibiotic	No of patient	Percentage
Amikacin	11	73.3
Ciprofloxacin	5	33.3
Cefotaxime	4	26.6
Piptaz	4	26.6
Meropenam	1	6

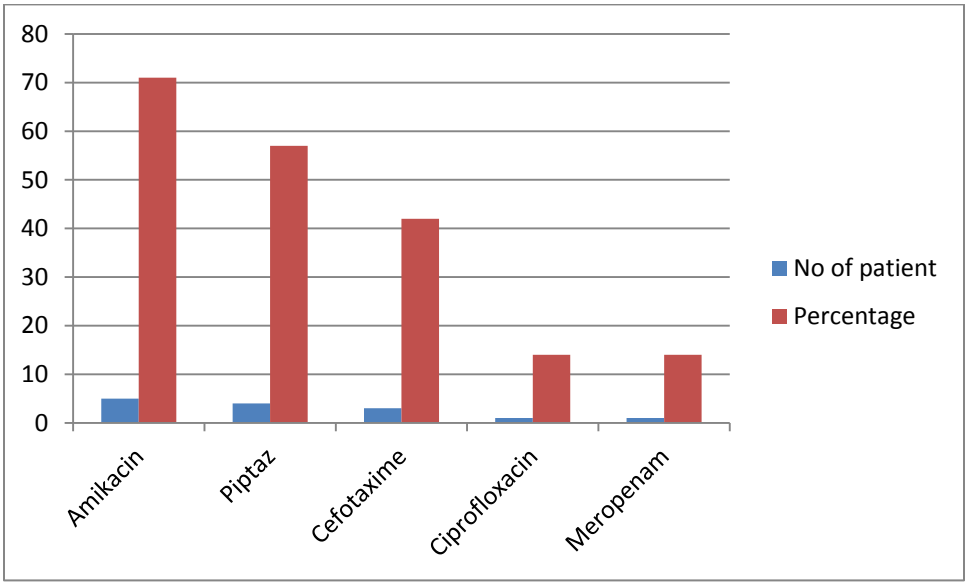
Graphical representation:



II) Pseudomonas aeruginosa (Table 8.2)

Antibiotic	No of patient	Percentage
Amikacin	5	71
Piptaz	4	57
Cefotaxime	3	42
Ciprofloxacin	1	14
Meropenam	1	14

Graphical representation:



Above two were the antibiotic sensitivities of common organism causing mesh infection among diabetic patients.Here Amikacin has high sensitivity against the two common bacterias in this group followed by others shown in the table.Antibiotic sensitivity for other organisms causing mesh infection though reported it is statistically not significant to represent here because of small sample size.

Discussion

From above study we come to know that incisional hernia repair was most surgery done in ventral hernia category and hence contribute to higher proportion in mesh infection among the mesh repairs done (59%).Factors affecting the rate of mesh infection was included in this study except mesh related factor because we commonly used Polypropylene mesh in almost all cases except few which involve vipromesh,this factor was kept as constant variable in this study. Diabetes which was commonly prevalent among population its influence on mesh infection was still debated and there was no standarized studies till now to establish its role. Other factors along with diabetes also plays important role in development of mesh infection they also taken in the study.

In our study design diabetes is the major factor which is responsible for development of mesh infection (55%) its direct effect on mesh infection is still doubtful most of our cases developed mesh infection in this group are following wound infection(73%).Since few studies proved statistically significant correlation between SSIs and mesh infection we assume wound infection is major factor contributes increased incidence of mesh infection in our study among diabetics.

Among other factors causing mesh infection obesity plays important role contributing about 34 %. But this may not exactly true since 44% in that group are associated with diabetes.But grouping these co morbid conditions are beyond the aim of

study and hence not done here. In males COPD and smoking also contributes significantly about 22% and 28% respectively for mesh infection.

On duration of onset of mesh infection most of the infection in our study group occurred early ie., within 3 weeks interval (53%) again favouring wound infection as important cause.More over it also depends on type and virulence of organisms causing mesh infection.For chronically infected wounds with staph epidermidis the onset was delayed to 2-11 months(13%).

With organisms Klebsiella followed by pseudomonas were the most common organism causing mesh infection in our study accounting for 51% and 24% respectively while others are E.Coli (14%),Proteus mirabilis(10%),Staph aureus(3%). In non-diabetic group Staph.aureus followed by Staph.epidermidis was common accounting 41% and 16% respectively.

Coming to antibiotic sensitivity for those above common causative organisms in diabetic group Amikacin was sensitive to both klebsiella and pseudomonas in about 73% and 71% of cases respectively followed by ciprofloxacin(33%) for klebsiella and Pitaz(55%) for Pseudomonas.For non diabetic group Ampicillin and cefotaxime was equally sensitive(60%). For staph epidermidis Vancomycin and Linzolid was sensitive.

With treatment of these patients almost all patients (95%) are treated with wound management with dressing,debridement and appropriate antibiotics as polypropylene

mesh was used mesh explantation was not required except for 3 cases (5%) in whom these conservative method was failed to relieve infection and their two or more associated comorbidities also significantly hindered normal wound healing response.

Conclusion.

From this study we can conclude diabetes is one of the major preventable cause of mesh infection along with factors in our hospital setting. Since there was no major published trial or studies on mesh infection standarised comparision with previous studies was not available.

Hence Klebsiella pneumoniae was commonest organism followed by Pseudomonas aeruginosa in diabetic group with both sensitive to amikacin we advise this antibiotic can be used as first line prophylactic antibiotic before surgery and as empirical treatment if infection sets in till culture & sensitive reports available.In case if patient has poor renal reserve second line antibiotic such as ciprofloxacin and piptaz can be used.For non diabetics routinely used antibiotic as prophylaxis such as Ampicillin and cefotaxime are enough to reduce to incidence of mesh infection.

To conclude this study in wholly based on single institution and common infective organisms may vary in different hospital settings. So each hospital has to do exact study to formulate appropriate antibiotic or large study involving different institutions to formulate proper antibiotic as whole and to prevent such infection as once infection sets in it is difficult to treat causing considerable morbidity to patients.

ABBREVIATIONS

VIH	-	Ventral incisional hernia
VH	-	Ventral hernia
PP	-	Polypropylene
ePTFE	-	Expanded Polytetrafluoroethylene
SSI	-	Surgical site infection.
VAC	-	Vacuum assisted closure.
EC	-	Enterocutaneous fistula.
COPD	-	Chronic obstructive pulmonary disease.
BMI	-	Body mass index.

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